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(12) # EUROPEAN PATENT APPLICATION

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(54) **A process method for cooling and/or heating and an apparatus for that method.**

(57) A plant for cooling and heating and a process using said plant with proportional adjustment of the rotatory speed, resulting in considerable saving of energy.

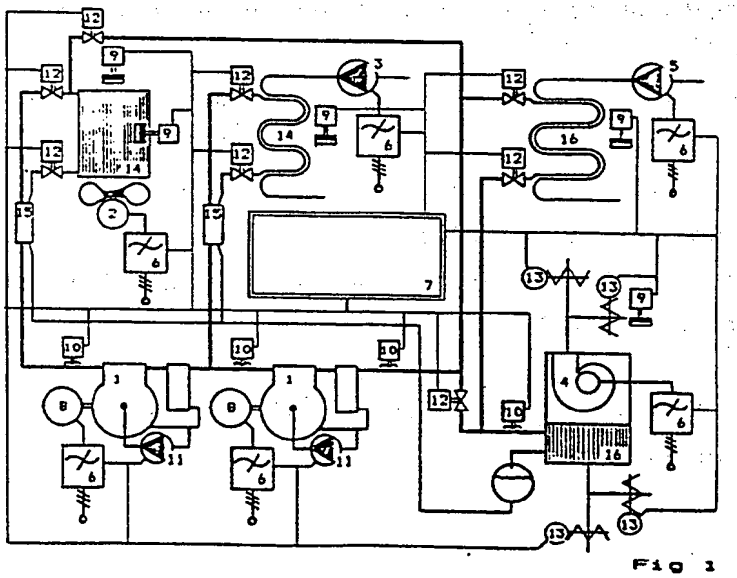

Fig 1

Croydon Printing Company Ltd

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Int. Class.:F 25 B.

Patent Application

Specification:

A process/method for cooling and/or heating, and an apparatus for said method.

Applicant/Inventor: Avontuur, Marinus Wilhelmus Matheus,
of Made (Netherlands).

The invention relates to a process/method for cooling and/or heating, by means of an electrically driven appliance, comprising one or several compressors, one or several evaporators and one or several condensors.

The technology of cooling has developed considerably during the past years, and it has got an ever increasing significance for domestic purposes, air-conditioning for dwellings, for industrial processes, for the preservation of food and of products from and for agriculture and stock breeding, as well as for medical and pharmaceutical applications.

On the other hand, the energy consumption is by far too high, and substantial savings of same are obligatory.

The known processes and aggregates became more efficient and more practical for the customer, however, the consumption of energy did not decrease in a mentionable way, because the opinion was, that only an improvement of the output yield would render the necessary savings.

However, it has appeared that this was an erroneous assumption.

The continuous rotatory motion of compressors, ventilators and pumps in the known aggregates results in an unnecessary high energy consumption, also in uncharged or little-charged conditions, even if the output yield is regarded to be reasonable.

A possibility has been sought to obviate this disadvantage by means of an improved system.

It has been found that a considerable saving of energy consumption together with an increase of the output yield can be obtained with the use of a process mentioned in the introduction, characterized in that an entirely or partially capacity dependent proportional adjustment of the velocity of rotation of the compressor (s), ventilators, pumps and/or adjustment of valves are put into practice by frequency transforming devices and that a preferably hermetically closed oil-pump for the device is put in a separate position independent of the compressor(s).

For the process method in accordance with the present invention a system is now used which consists of one or several compressors, evaporators with ventilators and/or pumps and one or several condensors with ventilators and/or pumps being provided with frequency transforming devices which adjust the speed of rotation, said frequency transforming devices being controlled by a microprocessor.

As a result of this adjustment of the velocity of rotation being effected by the frequency transforming devices a reduction of the energy consumed up till about 30% may be reached.

The process method and the installation are further described with a review of the enclosed figures 1 and 2, showing schematic drawings of functional embodiments of the installation according to the present invention, which however is not restricted to the number of components as represented.
Larger as well as smaller plants can be operated according to the present process method and will then be within the extent of the present invention.

In figure 1 a plant as designed for the process method according to the invention is shown schematically, wherein the compressors (1), the evaporators-ventilators (2) or - pumps (3) and the condensor valves (4) or - pumps (5) are indicated, provided with frequency transforming devices (6) operating as adjusting instruments for the velocity of rotation and being controlled by the microprocessor (7).

In the plant one or several piston compressors (1) are used, preferably of the open or indirectly driven type.
The electromotor (8) of compressor (1) is adjusted by the frequency transforming appliance operating as an adjustment device (6).

The control is effected by measurement of the temperature (9) and/or 0085454 of pressure (10).

In the known plants the oil pump is built in the compressor, but in the plant of the invention this is dismantled and replaced by a connector. For the process of the invention an externally situated hermetically closed oil pump (11) is linked with its own electrical drive which maintains an even pressure of lubricant oil at varying speeds of rotation which are effected by the compressor in this process method.

For larger capacities the speed of the evaporator-ventilators and of the condensor-ventilators and/or the pumps is also adjusted by the adjusting device (6).
The control takes place by temperature measurement (9) and/or pressure measurement (10).

The plant is provided with a microprocessor control (7) into which the following measured data from the system are supplied:

a) several temperatures of (9).
b) several pressures of (10).
c) the energy input of the compressors (1), the ventilators (2) and (4) and/or of the pumps (3) and (5) by means of the measurement of the current at the adjusting device of the speed of rotation (6).
d) the position of several electronically controlled valves (12) and of servodrives (13).

The measured data supplied are compared and checked.
By a step by step modification of the different adjustment data the most efficient values of the energy measurements are being determined.

The adjustment is obtained by the following:

a) the control of the adjusting devices of the speed of rotation (6), the electronically controlled valves (12) and the servo drives (13).
b) Switching in the system of illumination if any, of electrical or other kind of heating and thawing by means of hot gas and/or electrical current.
c) Reproduction of temperatures, pressures and energy consumption.
d) Calling attention to considerable deviations and interferences within the system.

e) Central recording of data and of interferences by telephone or otherwise.

At the cooling compressor (1), one or several evaporator units (14) are connected, operating within a defined range of evaporation temperature, and one or several condensor units (16), operating within a defined range of condensation temperature.
If several units are used within the same temperature range, the capacity will be determined by the unit requiring the largest temperature range.

The other units are being reduced by means of an electronically controlled valve (12) adjusting the flow of gas and/or liquid.
The speed of rotation of the ventilators is also adjusted.

Next to the evaporators, effective heat exchangers (15) are put up between the pipe for liquid and the suction pipe, so that with the reduction handling no extra losses will occur between the evaporator and the compressor.

In case the temperature steps I, II and III ranging are diverging considerably, several compressors (1) are situated in succession operating stepwise.
Each of the compressors with accessory adjustment for the rotation speed deals with a defined temperature range.

For the compressors combination operating stepwise with adjustment of rotation speed the entire system comprises the following:
a) A suction conduit pipe for each temperature range.
b) A conduit pipe for hot gas, also being useful for thawing and heat recovery.
c) A conduit pipe for the liquid.

The adjustment of the rotation speed results in the effect that the nominal charge will be regularly intercepted, so that on an average higher evaporation temperatures and lower condensation temperatures will occur.

Said nominal charge will be considerably lower than the peak charge, resulting in diminishing losses, on an average occurring by motion of parts (pistons, gearing etc.) and by resistance (of gas and liquid

in conduit pipes, valves, stop-cocks etc.)

Wear and average noise are also reduced.

In this system there is a possibility of an electronically controlled operation of gas - liquid - and expansion valves.

The putting into practice of the thawing by hot gas not only results in savings because no electrical thawing will be necessary, but also nearly always a clean evaporator is obtained, because the evaporator can be defrosted within short intervals of time.
Several times per 24 hours the entire unit is still being de-iced by the low cost heat available from hot gas.

Within certain intervals the flow velocity rates in the system can be increased during a short period, in order to maintain a fair flow of oil.

In this system peak charges and non - activity periods are made commensurate and can be bridged over.
Peak values by switching on and high values of current at start run will be avoided with this system, whereby in most cases lower costs of connection with the utilities' network can be obtained.

With the system the winning of heat for water and/or room heating is not at the expense of the energy consumption.
Cooling of rooms with the aid of this system is very attractive.

The switching on and off of illumination and for example the control of movement of coverings during the night can be accomodated in the form of adaptation.

Repair of interferences can be carried out in a fast manner, because of the central recording system and trouble signalling, so that damage will remain restricted.

Also with plants having several units and different temperature ranges to cover, the system of conduit pipes is a very simple one.

The control and adjustment of the condensor - ventilator (4) makes the

use of an extra ventilator for room conditioning directly 0085454
condensor superfluous.

The total system renders a very considerable saving of energy.
The system can find a broad field of applications, such as cooling of
5 cooling-storage-cells, closed and open refrigerators in supermarkets, plants for alimentary technology, storage possibilities in harbours, transport and haulage, refrigerated transport, heating of dwellings and living rooms, offices, use of heat pumps etc.

(Claims).

Claims:

1. A process method for the cooling and/or heating by means of an electrically driven plant, comprising one or several compressors, one or several evaporators and one or several condensors, characterized in that a proportional adjustment of the speed of rotation of the compressor(s), ventilator(s),pump(s) and/or valves in a total or partial capacity-dependent manner by frequency-transforming devices, together with an oilpump which operates independently from the compressor(s), are used in the system.

2. A process method according to claim 1, characterized in that a hermetically closed oilpump is used as the oilpump which operates independently.

3. A plant for the process method according to claim 1, characterized in a mounting of parts in conformity with figure 1, comprising the following parts: compressor(s) (1), driven by electromotor(s) (8), each connected with an evaporator - unit (14) and a heat exchanger (15), with an evaporator-ventilator (2), a pump (3), a condensor-ventilator (4), a pump (5) provided with frequency-transforming devices (6) operating as adjusters for the rotatory speed, controlled by the microprocessor (7), with temperature-measuring sensor (9) and/or pressure-measuring sensor (10), as well as electronically controlled valves (12) and servomotor drives (13), and provided with a separate oilpump (11), having its own drive.

4. Plant for cooling and/or heating purposes provided with means according to claim 3 operating according to the process method as rendered in claims 1 and/or 2.

5. Heat pump unit provided with means according to claim 3, operating according to the process as rendered in claims 1 and/or 2.

6. Stationary cooling unit, provided with means according to claim 3, operating according to the process as rendered in claims 1 and/or 2.

7. Mobile cooling unit, provided with means according to claim 3, operating according to the process as rendered in claims 1 and/or 2.

(Figures).

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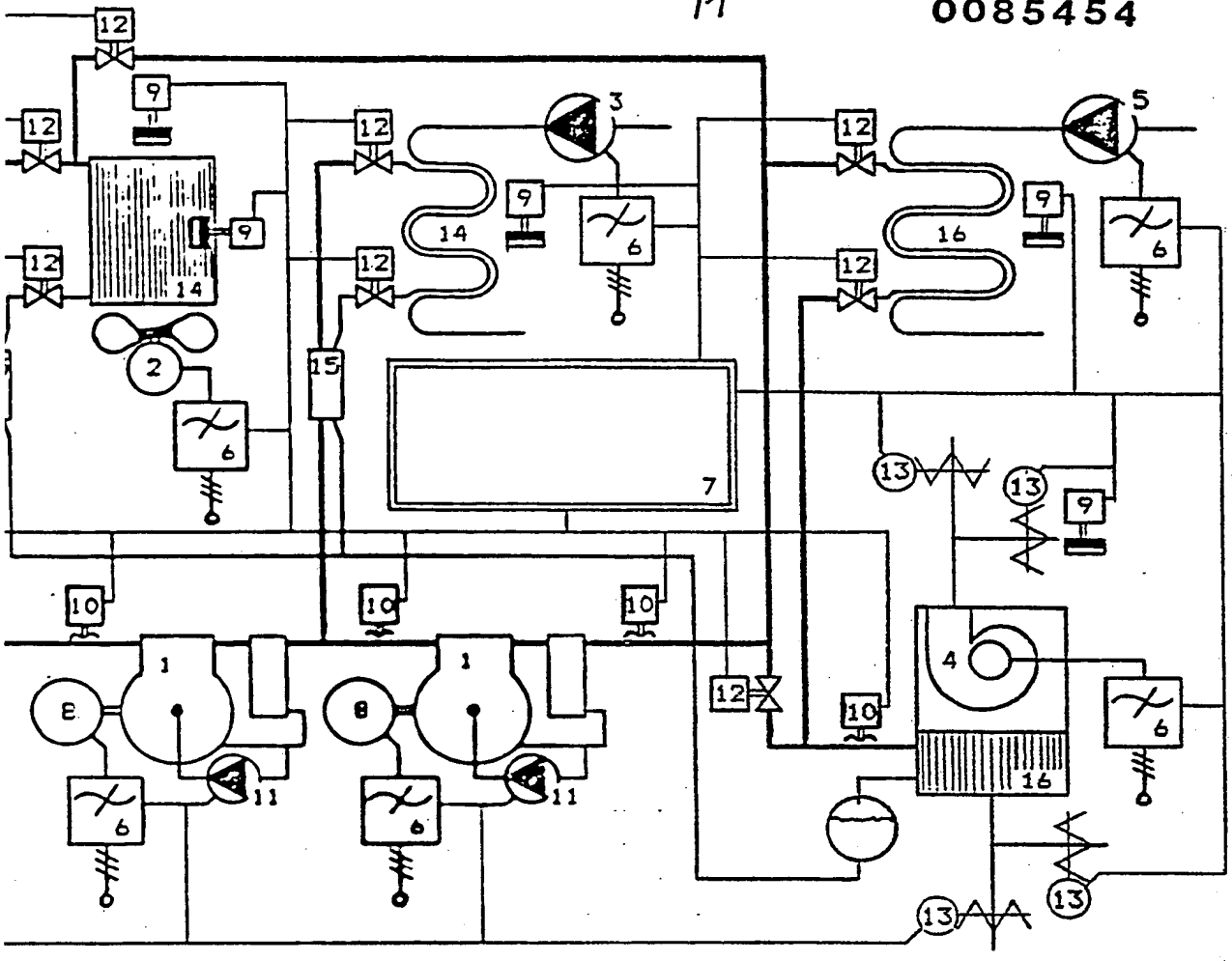

Fig 1

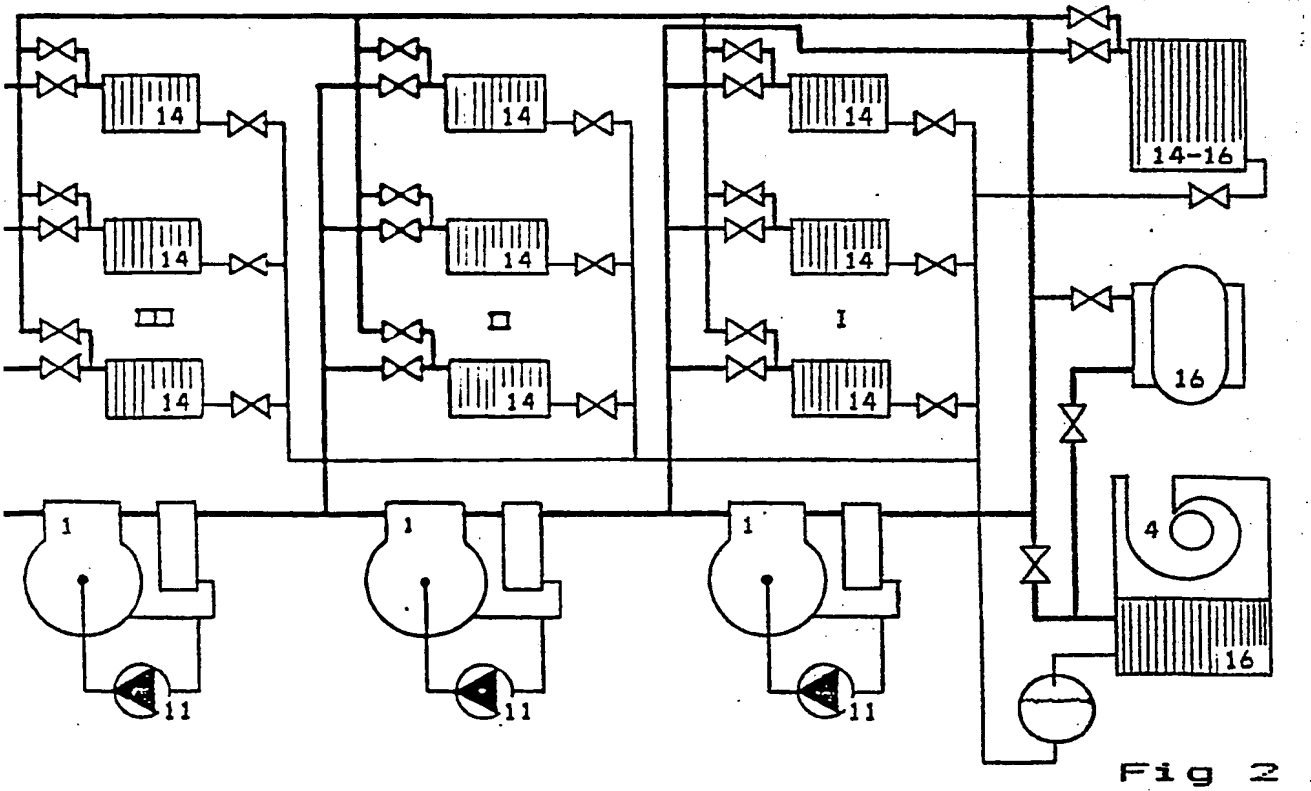

Fig 2

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(54) **A process method for cooling and/or heating and an apparatus for that method.**

(57) A plant for cooling and heating and a process for using said plant with proportional adjustment of the rotatory speed of the electrically driven components, with the object of saving energy.

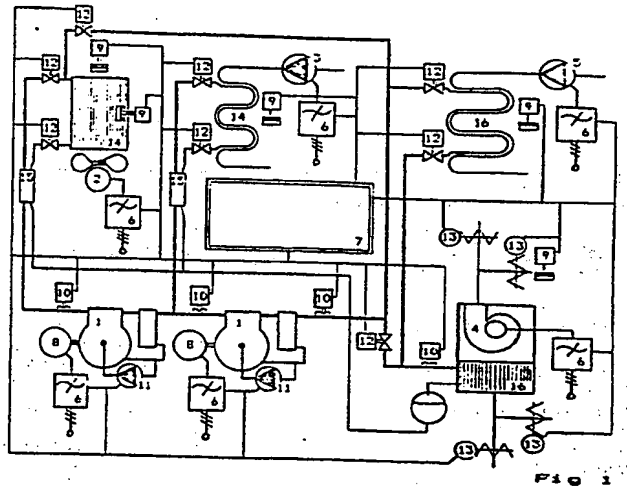

Fig 1

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European Patent Office

EUROPEAN SEARCH REPORT

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Application number

EP 83 20 0089

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-3 447 335 (RUFF et al.) * Whole document *	1,2	F 25 B 49/00
Y		3-6	
Y	US-A-3 668 883 (RUFF et al.) * Whole document *	3-6	
A	DE-A-2 451 361 (JAKOB et al.) * Whole document *	1,3,4,6	
A	US-A-4 257 238 (KOUNTZ et al.) * Whole document *	1,3-5	
A	US-A-3 803 863 (JEDNACZ et al.) * Column 3, lines 8-67; figure 1 *	1,7	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) F 25 B F 25 D
A	US-A-3 499 297 (RUFF et al.)		
A	US-A-3 324 672 (SONES et al.)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17-05-1983	SILVIS H.

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